

DYNAMIC CHARACTERISTICS OF OFFSHORE TENSION LEG PLATFORMS UNDER HYDRODYNAMIC FORCES

ASHRAF M. ABOU-RAYAN

Department of Civil Engineering Technology, Faculty of Engineering, Benha University, Al Qalyubiyah, Egypt

ABSTRACT

Tension leg platforms (TLP) are used for deep water oil exploration. Their behavior are highly nonlinear due to large structural displacements and fluid motion-structure interaction. Therefore the nonlinear dynamic characteristics of TLP under hydrodynamic forces is necessary for determining the maximum deformations and stresses. In this paper, numerical studies are conducted to compare the coupled responses of the triangular TLP with that of the square TLP. A numerical study using modified Morison equation was carried out in the time domain to investigate the influence of nonlinearities due to hydrodynamic forces and the coupling effect between surge, sway, heave, roll, pitch and yaw degrees of freedom on the dynamic behavior of TLP's. The stiffness of the TLP was derived from a combination of hydrostatic restoring forces and restoring forces due to cables and the nonlinear equations of motion were solved utilizing Newmark's beta integration scheme. The effect of wave characteristics such as wave period and wave height on the response of TLP's was evaluated. Only uni-directional waves in the surge direction was considered in the analysis.

KEYWORDS: Compliant Structures, Coupling Effect, Hydrodynamic Wave Forces